



TENNESSEE DEPARTMENT OF

**EDUCATION**

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## Automation and Robotics (PLTW)

<b>Primary Career Cluster:</b>	Science, Technology, Engineering, and Mathematics (STEM)
<b>Consultant:</b>	Bethany King Wilkes, (615) 532-2844, <a href="mailto:Bethany.Wilkes@tn.gov">Bethany.Wilkes@tn.gov</a>
<b>Course Code:</b>	TBD
<b>Prerequisite(s):</b>	None
<b>Credit:</b>	N/A
<b>Grade Level:</b>	7
<b>Graduation Requirement:</b>	N/A
<b>Coursework and Sequence:</b>	This is the second course in the <i>Project Lead the Way (PLTW)</i> middle school sequence of coursework.
<b>Necessary Equipment:</b>	Visit <a href="http://www.pltw.org">www.pltw.org</a> for more information.
<b>Aligned Student Organization(s):</b>	Technology Student Association (TSA): <a href="http://www.tntsa.org">http://www.tntsa.org</a> Amanda Hodges, (615) 532-6270, <a href="mailto:Amanda.Hodges@tn.gov">Amanda.Hodges@tn.gov</a>
<b>Coordinating Work-Based Learning:</b>	N/A
<b>Available Student Industry Certifications:</b>	N/A
<b>Dual Credit or Dual Enrollment Opportunities:</b>	N/A
<b>Teacher Endorsement(s):</b>	001, 013, 014, 015, 016, 017, 018, 047, 070, 078, 081, 101, 210, 211, 212, 213, 214, 230, 231, 232, 233, 400, 401, 402, 413, 414, 415, 416, 417, 418, 440, 470, 477
<b>Required Teacher Certifications/Training:</b>	<i>Project Lead the Way</i> training is required
<b>Teacher Resources:</b>	<a href="http://www.tn.gov/education/cte/doc/STEMResourceList.pdf">http://www.tn.gov/education/cte/doc/STEMResourceList.pdf</a>

### Course Description

This is a course in the series of *Project Lead the Way (PLTW)* curriculum. For more information, visit the PLTW website at <http://www.pltw.org/>.

## Program of Study Application

These courses build knowledge and skills related to the following career clusters:

- 1) Architecture & Construction
- 2) Information Technology (IT)
- 3) Manufacturing
- 4) Science, Technology, Engineering & Mathematics (STEM)
- 5) Transportation, Distribution, & Logistics

## Course Standards

The course standards outlined below are the copyrighted property of *Project Lead the Way*. Teachers must participate in *Project Lead the Way* training in order to be able to teach this course.

### Lesson 2.1 What is Automation and Robotics? (7 days)

#### *Understandings*

- 1) Automation is the use of technology to ease human labor or to extend the mental or physical capabilities of humans.
- 2) Robotics is the specialized field of engineering and computer science that deals with the design, construction, and application of robots.
- 3) The use of automation and robotics affects humans in various ways, both positively and negatively, including their safety, comfort, choices, and attitudes about a technology's development and use.
- 4) Automation and robotics have had an influence on society in the past and present and will influence society in the future.
- 5) Engineers, designers, and engineering technologists are in high demand for the development of future technology to meet societal needs and wants.

#### *Knowledge and Skills*

It is expected that students will:

- Describe the purpose of automation and robotics and its effect on society.
- Summarize ways that robots are used in today's world and the impact of their use on society.
- Describe positive and negative effects of automation and robotics on humans in terms of safety and economics.
- Provide examples of STEM careers and the need for these professionals in our society.

### Lesson 2.2 Mechanical Systems (12 days)

#### *Understandings*

- 1) Energy is the capacity to do work; the use of mechanisms is necessary to transfer energy.
- 2) Engineers and technologists design mechanisms to change energy by transferring direction, speed, type of movement, and force or torque.
- 3) Mechanisms can be used individually, in pairs, or in systems.



### *Knowledge and Skills*

It is expected that students will:

- Use ratios to solve mechanical advantage problems.
- Use numerical and algebraic expressions and equations to solve real-life problems, such as gear ratios.
- Use the characteristics of a specific mechanism to evaluate its purpose and applications.
- Apply knowledge of mechanisms to solve a unique problem for speed, torque, force, or type of motion.

## **Lesson 2.3 Automated Systems (26 days)**

### *Understandings*

- 1) Automated systems require minimal human intervention.
- 2) An open-loop system has no feedback path and requires human intervention, while a closed-loop system uses feedback.
- 3) Troubleshooting is a problem-solving method used to identify the cause of a malfunction in a technological system.
- 4) Comments do not change the way a robot behaves, but they do allow the programmer to remember the function that the code performs.
- 5) Invention is a process of turning ideas and imagination into devices and systems.
- 6) Some technological problems are best solved through experimentation.
- 7) Fluid power systems are categorized as either pneumatic, which uses gas, or hydraulic, which uses liquids. (FT Version)
- 8) Automated systems can be powered by alternative energy sources like solar and fuel cells. (FT Version)

### *Knowledge and Skills*

It is expected that students will:

- Know the seven technological resources and how they are integrated into an open and closed loop system.
- Describe the purpose of pseudocode and comments within a computer program.
- Know how to use ratio reasoning to solve mechanical advantage problems.
- Design, build, wire, and program both open and closed loop systems.
- Use motors and sensors appropriately to solve robotic problems.
- Troubleshoot a malfunctioning system using a methodical approach.
- Experience fluid power by creating and troubleshooting a pneumatic device. (FT Version)
- Design, build, wire and program a system operated by alternative energy. (FT Version)
- Explain the roles and responsibilities of mechanical, electrical, and computer engineers who solve robotic problems.

